



KIBOGORA POLYTECHNIC



**FACULTY OF HEALTH SCIENCE
DEPARTMENT OF NURSING**

**PREVALENCE OF ANEMIA AMONG PREGNANT WOMEN AND THE
ASSOCIATED FACTORS**

At Kibogora District Hospital & Kibogora Health Center

A RESEARCH PAPER SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE BACHELOR'S DEGREE WITH HONOR IN GENERAL NURSING.

PAPER PREPARED BY:

NYINAWUMUNTU Shoza
Registration number: 2001208

And

MUJAWIMANA Diane
Registration number: 2000576

SUPERVISOR:

KANAKUZE Chris Adrien, BSM, MSN, RM

Kibogora, March 2022

DECLARATION

Declaration by the Candidates

We, **NYINAWUMUNTU Shoza and MUJAWIMANA Diane**, hereby declare that this is our own original work and not a duplication of any similar academic work. It has therefore not been submitted to any other institution of higher learning. All materials cited in this paper which are not our own have been duly acknowledged.

Signed.....

.....

NYINAWUMUNTU Shoza

MUJAWIMANA Diane

Date: March 24th, 2022

Declaration by the Supervisor

I declare that this work has been submitted for examination with my approval as KP Supervisor.

KANAKUZE Chris Adrien, BSM, MSN, RM

signed.....

Date.....

ABSTRACT

Defined by the WHO as a hemoglobin level lower than 11.0 g/dl, anemia in pregnancy is one of the global public health problems where around 38% of pregnant women are affected. Prevalence of anemia in pregnancy varies between 17% and 31% in Europe and North America, 44-53% in South East Asia, and 53-61% in Africa. Rwanda has made tremendous progress in reducing most of the leading causes of maternal adverse outcomes (deaths, premature, abortions, etc.). In this line, the RDHS report published in 2020 showed a decline in the anemia prevalence among women from 23% to 13.1% since 2015. However, little is known about the prevalence of anemia among pregnant women and its associated factors at a decentralized level. This study in Kibogora DH & Kibogora HC comes to fill the gap.

This study undertook a quantitative cross-sectional design, and has recruited 174 pregnant women attending ANC services in Kibogora DH & Kibogora HC using a simple random sampling method. Data was collected using questionnaires, entered into Microsoft Excel, and exported in SPSS for analysis.

Through SPSS software, the descriptive and logistic regression statistics were produced. Of all 174 participants, 93.10% reside in rural setting, 79.9% of them were married, and 78.8% had at least the primary level of education. In order to prevent anemia, 90.8% and 79.9% adhere to the regular balanced diet and full course of folic acid intake, respectively. Our study has revealed that the prevalence of anemia in pregnancy among women attending the ANC services of Kibogora DH & Kibogora HC is estimated to be 19%, and its associated factors are namely; not having attained any level of education (cOR 1.3, 95% CI, 1.00, 1.44; P=0.000); having completed only the primary level of education (cOR 1.2, 95% CI, 0.12, 1.33; P=0.040), earning less than FRW 30,000 monthly income by the pregnant women (cOR 2.6, 95% CI, 1.00, 4.43; P=0.012) and lastly, partially intake of folic acid (cOR 2.1, 95% CI, 2.7, 3.21; P=0.030).

Therefore, strengthen the comprehensive education program targeting the young girls and future women, develop and implement the small income-generating activities targeting the unemployed women, and organize the sensitization sessions (IEC, BCC) regarding the intake and the importance of folic acid to the pregnant women should alleviate the problem.

Keywords: Anemia in pregnancy, Prevalence, Associated Factors, Kibogora DH & Kibogora HC

DEDICATION

To lecturers of Kibogora Polytechnic;

To our families;

To our friends, and Colleagues;

We dedicate this work!

ACKNOWLEDGEMENTS

First and foremost, our sincere appreciation goes to our almighty God for giving us life and courage that leads to the achievement of this work.

We wish to reiterate our gratitude to Kibogora Polytechnic (administrative and lecturers) for providing us the required skills that enabled us to conduct this research in Kibogora Hospital and Kibogora HC. These grew simultaneously our theoretical and practical experience.

We are very grateful to all people who, in one way or another helped us to finish this work and our studies. Our heart felts thanks go to our supervisor KANAKUZE Chris Adrien who kindly accepted to supervise this dissertation in spite of many other responsibilities. Our sincere thanks also go to all lecturers who taught us at Kibogora Polytechnic. In this line, we thank also the Staff of Kibogora Hospital and Kibogora HC for having contributed to this dissertation by providing the necessary data and information.

It would be ungrateful to forget all our friends and classmates. Their relationship and their good ideas will not be forgotten since they were played a precious contribution during our studies.

We finally recognize who, directly or indirectly, have lent their helping hand in this dissertation.

May Almighty God bless you!

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ACRONYMS

ANC	Antenatal Care
BCC	Behavioural Communication Change
CI	Confidence Interval
cOR	Crude Odds Ratio
DHS	Demographic and Health Survey
FHD	Family Health Division
GHS	Ghana Health Service
Hb	Hemoglobin
HC	Health Center
HF	Health Facility
HIV	Human Immunodeficiency Virus
ID	Iron deficiency
IDA	Iron Deficiency Anemia
IEC	Information, Education, and Communication
KP	Kibogora Polytechnic
LMC	Low Middle-Income Countries
NISR	National Institute of Statistics of Rwanda
RBC	Red Blood Cells
RDHS	Rwanda Demographic and Health Survey
SES	Socio-Economic Status
SPSS	Statistical Package for Social Sciences
TB	Tuberculosis
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Education Fund
WHO	World Health Organization

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CHAPTER ONE: GENERAL INTRODUCTION

1.0 Introduction

This chapter one covers the background of the study, problem statement of the study, general and specific objectives of the study, research questions of the study, the significance of the study, justification of the study, and finally the limitations of study.

1.1 Background of the study

Anemia is defined as a hemoglobin (Hb) level lower than 11.0 g/dl ($Hb < 11.0\text{g/dl}$) in pregnant women and Hb lower than 10.0 g/dl ($Hb < 10.0\text{g/dl}$) in postpartum mothers (Lebso *et al.*, 2017). Globally, anemia prevalence is estimated by the World Health Organization (WHO) to be 38% in pregnant women (Kofie, *et al.*, 2019). Around 40% of women begin their pregnancy with low or absent iron stores (serum ferritin $< 30\text{mg/l}$ and up to 90% have iron stores of 500mg (serum ferritin $< 70\text{mg/dl}$) worldwide, which is insufficient to meet the increased iron dependency in both pregnant and postpartum period (Kofie, *et al.*, 2019).

In all continents the prevalence of anemia in pregnant women has been reported to be highly variable, ranging from 17% to 31% in Europe and North America, 44-53% in South East Asia, and 53-61% in Africa (Brien & Ru, 2017). Moreover, the most common form of anemia in pregnant women is iron deficiency anemia (IDA) and 50% of anemia is attributable to iron deficiency (Annik *et al.*, 2019). Consequently, anemia can lead to further negative health outcomes for both mothers and their babies, including infections, premature rupture of membrane, fetal growth restriction, low birth weight, and fetal death (Tan *et al.*, 2020).

In South Asia, the majority of anemia cases occur in India where half of the pregnant Indian women are anemic with (Hb<110g/l) (Chakrabarti & Scott, 2019). The National Nutritional Survey of Pakistan estimated anemia presence in 41.7% pregnant women and a higher proportion of anemic pregnant women was in rural areas (44.3%) as opposed to the urban areas (40.2%) (Aziz Ali,*et al.*, 2021). Unfortunately, the study conducted by Liyew in 2021, *et al.* showed that anemia contributes to 20% of deaths among pregnant women, and the highest-burden is endured by the sub-Saharan regions where 17.2 million pregnant women were reported to be anemic all along the pregnancy period (Liyew, *et al.*, 2021).

In Sub-Saharan Africa, anemia among pregnant women is highest in West Africa, with a prevalence of 56% which is mainly associated with several adverse events for both the mothers and babies (Chakrabarti & Scott, 2019). Rwanda Demographic Health Survey has reported that anemia in pregnant women was estimated to be 23% which was an undeniable threat considering its adverse outcomes to both mother and fetus (NISR, 2015). However, in Rwanda, statistics showed that over the last five years from 2015, the prevalence of anemia among pregnant women has declined from 23% (Donahue Angel *et al.*, 2017) to 13.1% (NISR, 2020) countrywide. Despite the effort made, the prevalence of anemia among pregnant women has stagnated in recent years and originated from inadequate dietary iron intake and other maternal recurring diseases during pregnancy (Hakizimana *et al.*, 2019). Therefore, as there isn't any recent study conducted for assessing such anemia prevalence among pregnant women and its associated factors in a rural setting like Kibogora Hospital's catchment area, this study aims to fill the literature gaps identified in the region.

1.2 Statement of the problem

Rwanda has made possible progress in improving maternal health, including the anemia reduction from 23% to 13.1% among pregnant women from 2015 to 2020 respectively (NISR, 2015, National Institute of Statistics of Rwanda, Ministry of Health, The DHS Program ICF, 2020). However, anemia is a burden in both pregnant mothers and women of reproducing ages (Donahue Angel, *et al.*, 2017). A multi-level analysis in five sub-Saharan Africa on prevalence and determinants of anemia among pregnant women in East Africa showed that the highest rate of anemia in pregnant women was hosted in the sub-Saharan region where 17.2 million pregnant women were reported to be anemic, and the prevalence of anemia among pregnant women in East African countries was varying between 57.10% Tanzania, and 23% for Uganda and Rwanda, respectively. Therefore, with such a high anemia burden during pregnancy, Rwanda has considered this problem as one of the public health issues since it puts the affected women at high risk of numerous complications to fetus and women herself during and after pregnancy. Since 2016, Rwanda has adopted recommendations elaborated by WHO for coping with anemia among pregnant women that include systematic testing of anemia starting with the first antenatal care visit, daily oral iron and folic acid supplementation with 30 mg to 60 mg of elemental iron and 400 g (0.4 mg) of folic acid for pregnant women to prevent maternal anemia, puerperal sepsis, low birth weight, and preterm birth, among others (National & Pillars, n.d.). Despite this existing ANC guidelines, the routinely collected data in Kibogora Health Facilities using the Health Information System (HMIS) showed that the coverage of anemia testing among the pregnant women attending ANC services has declined from 68.1% (2020) to 67.3% (2021), while the coverage of iron / Folic acid intake varies from 96.3% (2020) and 96.2% (2021); these analyses show the weaknesses of Kibogora HFs to comply with the ANC guidelines as well as to reduce anemia in the region. Therefore, identifying prevalence of anemia and associated factors are crucial for the development of the evidence-based

intervention in the prevention of anemia; hence, conducting this study in Kibogora DH& Kibogora HC among pregnant women will describe the real situation for action.

1.3 Purpose of study

The purpose of this study is to fill the RDHS literature gap at a decentralized level like Kibogora DH & Kibogora HC in assessing prevalence of anemia among pregnant women and the associated factors. Findings from this study would be baseline for the future researchers interested on anemia in pregnancy, and shape the evidence - based interventions.

1.4 Objectives of the study

1.4.1 General objective

The study aimed to assess prevalence of anemia among pregnant women and associated factors at Kibogora DH & Kibogora HC.

1.4.2 Specific Objectives

1. To determine the prevalence of anemia among pregnant women and associated factors at Kibogora DH & Kibogora HC.
2. To identify factors associated with prevalence of anemia among pregnant women and associated factors at Kibogora DH & Kibogora HC.

1.5 Research questions

1. What is prevalence of anemia among pregnant women at Kibogora DH & Kibogora HC?
2. What are factors associated with anemia among pregnant women at Kibogora DH & Kibogora HC?

1.6 Significance of study

This study provides prevalence of anemia among pregnant women and associated factors at Kibogora DH & Kibogora HC. Filling the gap in terms of factors associated with anemia in pregnancy would enable the Health Facilities in Kibogora to provide evidence-based interventions through daily care among pregnant mothers. Furthermore, the Government through the Ministry of Health and Local government design holistic strategies for tackling this issue, including education of the stakeholders on prevention and control measures starting from general home lifestyle adjustment. Finally, the study will be important for further deductive research.

1.7 Limitations of study

This study is limited to Kibogora DH & Kibogora HC. So, findings could not be generalized to the whole country. However, they may be used in rural settings with the same similarities with Kibogora DH& Kibogora HC.

1.8 Scope of study

1.8.1 Geographic scope

This study was only based in Kibogora DH& Kibogora HC located in Nyamasheke District, Western Province. This allowed the study to be completed within a specified period and help to timely provide recommendations to be implemented in order to improve maternal health in the region.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

Apart from definitions of key concepts, chapter two of this study summarizes information regarding prevalence of anemia in pregnancy and the evidence-based associated factors (socio-demographical, nutritional, obstetrical, socio-economical, behavioral, etc.) drawn from different empirical studies in line with anemia in pregnancy.

2.1 Definitions of key concepts

2.1.1 Anemia

In this study, anemia is defined as a Hemoglobin level lower than 11.0 g/dl in pregnant women and a Hemoglobin level lower than 10.0 g/dl in postpartum mothers (Kofie *et al.*, 2019).

2.1.2 Hemoglobinopathies

Hemoglobinopathy is a group of disorders in which there is abnormal production or structure of the hemoglobin molecule. It is therefore inherited and includes hemoglobin C disease, hemoglobin S-C disease, sickle cell anemia, and thalassemia (Susanti *et al.*, 2017).

2.1.3 Thalassemia

In this research study thalassemia in pregnancy is an inherited blood disorder that causes women's bodies to have less hemoglobin than normal. While hemoglobin enables red blood cells to carry oxygen, thalassemia can cause anemia in pregnancy leaving them lazy (Brien & Ru, 2017).

2.2 Prevalence of anemia among pregnant women

Globally, the WHO has estimated anemia prevalence among pregnant women to 38%. The same report has classified such anemia prevalence as the world public health problem which becomes severe when it is greater than or equal to 40% (Kofie *et al.*, 2019). In general anemia in pregnancy depends partly on the nutritional status of the population, it affects 30%-80% of women in developing countries, and 10% in industrialized countries (Lebso *et al.*, 2017).

In Europe, the WHO report published in 2011 has estimated prevalence of anemia at approximately 26% among pregnant women, but recent studies have estimated prevalence of anemia in pregnancy to be 21% (Robalo Nunes *et al.*, 2020).

In China, many deliveries occur every year. In 2016 for example, there were 18,466,561 live births and with the recently implemented two-child policy, reducing anemia and IDA during pregnancy has become their national priority for antenatal care (Lin *et al.*, 2018). In the country of Indonesia, the prevalence of anemia among pregnant women was declining over time, but the number is still as high as more than 35% and the country is located in the thalassemia belt which risks the population to anemia (Susanti *et al.*, 2017).

In Ghana, a report by the Family Health Division (FHD) of the Ghana Health Service (GHS), showed that anemia among pregnant women at first antenatal clinic visit slightly increased by 1% in the year 2015 as compared to the previous year and then the report further stated that the prevalence of anemia in pregnant women at 36 weeks of pregnancy also increased slightly from the year 2015 to 2016 (Kofie *et al.*, 2019). The Volta Region has been identified as the region with the highest prevalence of 49% of anemia among women in their reproductive age between 15 and 49 years old (Kofie *et al.*, 2019). Moreover, the FHD has reported anemia in the region

at the time of antenatal clinic registration, and at 36 weeks of pregnancy to be 46% and 32% respectively in 2014; and despite the iron and folic acid provision, anemia remained the leading cause of hospital admissions and maternal deaths in the Volta Region (Kofie *et al.*, 2019).

Many studies show that anemia in pregnancy is internationally common. However, Africa and Asia endure the greatest burden. Africa and southeast Asia have a prevalence estimated to be 61.3% and 52.5%, respectively (Ndegwa, 2019). Anemia is twice common in sub-Saharan compared to America and Europe where the prevalence is estimated to be 24.1% and 25.1%, respectively (Sunguya,*et al.*, 2021). According to a joint report from the United Nations Population Fund (UNFPA), World Health Organization (WHO), United Nations Children's Education Fund (UNICEF), and the World Bank, over 800 women die daily from pregnancy complications and 99% of these mortalities are occurring in developing countries. Over the world, anemia is an eminent cause of death among pregnant women and about 40% of all maternal deaths during parturition are attributed to anemia (Ayensu *et al.*, 2020). In Ethiopia, anemia in pregnancy is still a public health problem in the country wherein different regions of Ethiopia especially in Somali the prevalence was (49.9%) and in Darawere (33.2%) (Tulu *et al.*, 2019). In fact, the severity of the adverse outcomes of anemia in pregnancy depends largely on the severity of anemia itself and the its outcomes lead to serious pregnancy complications which are proved by maternal mortality of 576 deaths per 100,000 live births (Sunguya *et al.*, 2021).

Despite efforts in place to overcome persistent maternal deaths in Tanzania, anemia remains one of the important indirect causes of 14.5% of maternal death in Tanzania and is associated with inadequate dietary diversity coupled with inadequate daily meal intake (Sunguya *et al.*, 2021). In Rwanda, anemia in pregnancy is also a public health concern, affecting 23% in 2015 and 13.1% in 2020 (Donahue Angel *et al.*, 2017). However, the prevalence of anemia among

pregnant women has stagnated in recent years and originated from inadequate dietary iron intake and other maternal recurring diseases during pregnancy (Hakizimana *et al.*, 2019).

2.3 Socio-demographic factors and pregnancy of anemia in pregnancy

In all continents the prevalence of anemia in pregnant women has been reported to be highly variable, ranging from 17% to 31% in Europe and North America, 44-53% in South East Asia, and 53-61% in Africa (Brien & Ru, 2017).

2.3.1 Age of pregnant women and anemia

According to previous studies, the age of pregnant women was evidenced to be one of the important factors that contribute to anemia during pregnancy. For instance, a multilevel mixed-effects generalized linear model study conducted by Achamyaleh Birhanu Teshale *et al.* on anemia and its associated factors among women of reproductive age in eastern Africa showed that older age has not any statistical correlation with anemia among pregnant women this is in the line with the study conducted by Naimo Khalif Mahamoud *et al.* on Prevalence of Anemia and Its Associated Socio-Demographic Factors among Pregnant Women attending an Antenatal Care Clinic at Kisugu Health Center IV, Makindye Division, Kampala that identified the high prevalence of anemia among women aged 15-20 which was estimated to 37.9% compared with their counterpart aged 41 and above with 0% anemia prevalence (Mahamoud *et al.*, 2020).

2.3.2 Place of residence of pregnant women and anemia

The implications of anemia among pregnant women are more pronounced as Hb levels reduce with the residence place due to the life habits which differ from the rural to the urban settings. In Pakistan, the National nutritional survey has revealed the presence of 41.7% anemic

pregnant women with a higher proportion in rural areas estimated at 44.3% as opposed to 40.2% in the urban areas (Aziz Ali *et al.*, 2021).

2.3.3 Marital status of the pregnant women and anemia

The study conducted by Betregiorgis Zegeye *et. al* that examined the prevalence of anemia and its associated factors among married women in 19 countries in SSA showed that the prevalence of anemia varied from approximately 45.5% to 34.2% among married women in the poorest and richest households respectively (Zegeye *et al.*, 2021). On an other hand, the study conducted by Naimo Khalif Mahamoud *et al.* on the prevalence of anemia and its associated socio-demographic factors among pregnant women attending ANC clinic at Kisugu Health Center IV, Makindye Division, Kampala showed that the anemia was more prevalent to the married pregnant women at 77.5% compared to the single (39.2%) and the separated (1.1%) (Mahamoud *et al.*, 2020).

2.3.4 Education and anemia among the pregnant women

Anemia prevalence varied with the socio-demographic characteristics. For instance, about 48.4% of married women who had not attained formal education were anemic, while 30% of married women who attended higher schools were anemic. Similarly, nearly half (49.4%) of women whose husbands had no formal education were anemic and it lowered to 34.7% among married women whose husbands had higher education (Zegeye *et al.*, 2021).

2.4 Socioeconomic status and anemia among the pregnant women

2.4.1 Women' occupation and anemia

The effect of the mothers' occupation is a complex phenomenon. To the employed women, diets are highly composed of non-traditional diets and supplements which is believed to

decrease their risk of nutritional-related anemia. The study conducted by Naimo Khalif Mahamoud et al. on the prevalence of anemia and its associated socio-demographic factors among pregnant women attending ANC clinic at Kisugu Health Center IV, Makindye Division, Kampala have shown that anemia was highly identified to the not employed pregnant women at 69.7% compared with their counterpart employed pregnant women which anemia affect only 30.3% (Mahamoud et al., 2020). The study conducted by Gebreweld & Tsegaye in 2018, on prevalence and factors associated with anemia among pregnant women attending ANC clinic at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia, the researcher has demonstrated that the anemia was more prevalent in housewife women (14%) compared to the workers in private agencies (9.7%) and government (12.5%) (Gebreweld & Tsegaye, 2018),

2.4.2 Income and anemia among the pregnant women

According to Gracitelli et al., 2015, the relationship between the low socio-economic conditions and the high risk of having the disease and mortality has been reported consistently in many different situations (Gracitelli et al., 2015). Several studies have revealed that anemia is most prevalent among the Low and Middle-Income Countries (LMIC). For instance, the poorer population in developing countries like India, Pakistan, and Bangladesh are mostly affected by anemia among pregnant mothers and its associated adverse outcomes (Kanjilal, 2020). According to the United Nations (UN) report, the anemia prevalence was varying between 56% in the Low Income-Countries and 18% in the high-income countries; it is normally influenced by socioeconomic conditions, lifestyles, and health-seeking behaviors (Kanjilal, 2018). The study conducted by Alemneh Mekuriaw Liyew in 2021 on prevalence and determinants of anemia among pregnant women in East Africa has revealed that anemia is also associated with the unimproved

literacy level among the community (Liyew et al., 2021a); and the literacy level is low among the developing countries, especially in Sub Saharan Africa (SSA) that include Rwanda.

2.5 Obstetric factors

2.5.1 Gestational age, gravidity

As long as the pregnancy evolves as the maternal plasma volume increments proportionally to the red cell mass, and accounts for the fall in hemoglobin concentration. The study conducted in Ethiopia by Angesom Gebreweld on prevalence and Factors Associated with Anemia among pregnant women attending antenatal clinic at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia has revealed that pregnant women in the second and third trimester were more likely to be anemic when compared to the pregnant women in the first trimester (Gebreweld & Tsegaye, 2018); however, these findings were in contradiction with those published by Mahamoud et al., 2020 showing that the anemia is relatively high (38.2%) among pregnant women in the first trimester gestational age compared to 18.4% and 26.8% for the second and third trimester, respectively (Mahamoud et al., 2020). Therefore, the fetal iron requirements increase in the third trimester and fetal growth increases in this period, when pregnant women experience maternal iron deficiency anemia in the early third trimester, fetal growth retardation owing to insufficient circulation and oxygenation is possible (Col Madendag et al., 2019). Gestational age, parity, and occupation of the mother were also associated with the risk of growing fetus and increasing hemodilution (Mahamoud *et al.*, 2020).

2.5.2 Antenatal care visits

According to the literature, during the pregnancy course, the pregnant woman needs to be regularly consulted through antenatal care visits at least once a quarter. A pregnant woman who had at least

3-4 and above four visits had a 51% and 64% less chance of developing anemia during pregnancy than those who had less or none at all (AOR, 0.49; 95% CI, 0.19–0.98, and AOR, 0.36; 95% CI, 0.08–0.64), respectively (Alemu & Umeta, 2015). The same study proves that pregnant mothers who timely (<4 months) started antenatal care visits were found to be no anemic compared to those who started late (4-5 months) and too late (6–9 months). According to the study conducted by Umesh Kumar Yadav in 2021 on factors associated with anemia among pregnant women of underprivileged ethnic groups in ANC service at the provincial level hospital of province 2, Nepal Women who had not completed four antenatal visits were twice more likely to be anemic than those completing all four visits. The odds of anemia were three times higher among pregnant women who had not taken deworming medication compared to their counterparts (Yadav et al., 2021).

2.6 Nutritional factors

2.6.1 Iron Deficiency and anemia

Iron deficiency (ID) is the main contributing factor of anemia, generally caused by insufficient dietary iron intake or by conditions causing hemorrhage or decreased iron absorption. Approximately, 50% of anemia cases in pregnancy can be explained by ID and it is more likely to occur when the iron requirement is increased, such as during pregnancy, menstrual bleeding, and insufficient dietary intake (Robalo Nunes, *et al.*, 2020).

Moreover, due to the increased demand for iron, a normal diet cannot meet the demand of some pregnant women for iron especially women with an already established iron deficiency, and consequently, anemia not only increases the risk of adverse pregnancy outcomes but also reduce cognitive function and as well as the reduction in work efficiency (Wu *et al.*, 2020). Like the other studies, the study conducted in Ethiopia highlights that the increase in iron requirements is mainly due to physiological demands during pregnancy, poor iron bioavailability, intestinal

parasitic infections, malaria, hemoglobinopathies, and chronic infections like tuberculosis (TB) and HIV (Kumera, *et al.*, 2018).

Anemia during pregnancy is moreover associated with adverse outcomes including both maternal perinatal morbidity and mortality. It is indeed associated with preterm birth and low birth weight, impaired cognitive development in children as well as a reduction in women's work productivity during pregnancy. Women usually become anemic during pregnancy basically on the increased requirement for both iron and other vitamins increases due to the physiological burden of pregnancy. Unfortunately, the inability to meet the demand for those nutrients is the main result of either dietary deficiency or infection, which initiate anemia in pregnant women (Kumera *et al.*, 2018). Interestingly, iron deficiency is protective for malarial infection during pregnancy, and iron supplementation in any malarial endemic area may thus increase infection susceptibility and trigger the rupture of red blood cells in pregnancy (Susanti *et al.*, 2017). The no supplementation of iron / folic acid was also evidenced to be one of the determinants of anemia among pregnant women; the study conducted by Angesom Gebreweld in 2018 on prevalence and factors associated with anemia among pregnant women attending ANC clinic at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia among the anemic pregnant women, showed that the lack/low of iron / folic acid intake was significantly associated to anemia on pregnancy as it increases by four times the chance of falling in anemic stage [AOR 4.03 CI 95% (1.49-10.92) P=0.01] (Gebreweld & Tsegaye, 2018).

2.6.2 Dietary habits during the pregnancy and anemia

For the health sake of both a pregnant woman and her fetus, good dietary habits during pregnancy play a crucial role in determining the long-term nutritional status of both the mother and the fetus (Liyew, *et al.*, 2021). Studies have shown that dietary inadequacy due to dietary

habits and patterns is higher during pregnancy than at any other stage of the life cycle. It is by unawareness that many women in developing countries restrict their food intake during pregnancy, for fear of having a large gestational age baby, which they think can predispose them to birth complications and as well as for cultural reasons (Gibore *et al.*, 2021). Thus more, poor dietary habits during pregnancy can result in a low intake of essential nutrients like proteins, vitamin C, vitamin A, and iron. And the absence of these nutrients in the diet trigger anemia, which contributes to increased rates of stillbirths, premature birth, low birth weight, and maternal and prenatal death (Aziz Ali *et al.*, 2021).

It is reported to be poor dietary habits among pregnant women to consume excess of tea, coffee, or cocoa during meal times, and reduction in number of meals per day (less than 3 meals), and lack of dietary diversity (Gibore *et al.*, 2021).

2.7 Other factors

2.7.1 Hemoglobinopathies and thalassemia

Low Hb can be caused by hemoglobinopathies, especially in an area where thalassemia traits prevalence is high. Pregnant women with thalassemia carriers may not have enough iron due to erythropoiesis by hepcidin suppression, and excessive iron supplementation may subsequently increase the risk for various complications (Liyew, *et al.*, 2021). Advanced ideas show that anemia in pregnancy in every hospital setting needs to be discovered whether due to iron deficiency or other causes needs to be further explored for the health sake of pregnant mother and her fetus (Susanti, *et al.*, 2017).

2.7.2 Intestinal parasitic infection

Tens of millions of pregnant women as one of the segments of the community are affected by parasitic infections which elevate the chance of anemia among pregnant women (Derso *et al.*, 2016). Parasitic infection can directly or indirectly lead to a spectrum of adverse maternal and fetal and placental effects. Pregnant women often experience more severe infections than non-pregnant women and could affect the health of a mother at any stage of the three trimesters during pregnancy, but infection during the first trimester is associated with maternal anemic problems and fatal consequences than those occurring later in pregnancy (Derso,*et al.*, 2016).

Furthermore, infection becomes more severe in women who are pregnant for the primigravida compared with another gravida. Amoebiasis, ascariasis, hookworm infection, and trichuriasis are among the ten most common infections in the world which invade the life of a pregnant mother and cause mild, moderate, and severe anemia among pregnant women. Anemia is more common in developing countries because of poor nutritional status and high prevalence of parasitic infection (Mengist *et al.*, 2017).

Intestinal parasitic infections especially helminthes increase anemia in pregnancy which negatively lowers pregnancy weight and intrauterine growth retardation followed by low birth weight, with its associated greater risk of infection and higher prenatal mortality rates (Derso *et al.*, 2016). It was reported that 44 million pregnant women have hookworm infections which can cause a chronic loss of blood from the intestines and predisposes the women to develop iron deficiency anemia (Mengist *et al.*, 2017).

2.7.3 Malaria infection and anemia among the pregnant women

According to WHO, malaria is a life-threatening disease caused by infection through the bite of a female anopheles mosquito which transmits protozoan parasite plasmodium (World Health

Organization, 2016). The most of time, malaria remains a major cause of anemia in tropical areas because it causes hemolysis of infected and uninfected erythrocytes and bone marrow dyserythropoietic which compromises rapid recovery from anemia (White, 2018). For instance, the study conducted by Gebreweld, et al. on the prevalence of malaria and anemia among Pregnant Women attending a Traditional Birth Home in Benin City, Nigeria has shown that the prevalence of anemia among pregnant women with malaria was 68.75% compared to those without malaria infection (42.31%) (Gebreweld & Tsegaye, 2018), and this is in the same line with the study conducted by Bankole Henry Oladeinde which has also revealed that the prevalence of anemia in pregnant women was 46.2% which was significantly affected by malaria compared with 28% to the pregnant women without malaria infection (Oladeinde et al., 2012).

2.7.4 Anemia and high altitude living among pregnant women

According to World Health Organization, anemia is defined as hemoglobin lower than 11g/dl in pregnant women and lower than 12g/dl in non-pregnant women (Tan *et al.*, 2020). A study conducted in China adjusted the thresholds for altitude since it was related to hemoglobin concentration (Wu *et al.*, 2020). The World Health Organization adjusted anemia thresholds for people living at higher altitudes than 1000 m, thresholds plus 2g/l for people living at altitudes between 1000 m and 1500 m; plus 5 g/l for those living at altitudes between 1500 m and 2000; plus 8 g/l at 2000-2500m; plus 13 g/l at 2500- 3000 m; plus 19 g/l at 3000-3500m; plus 27 g/l at 3500-4000 m; 35 g/l at 4000- 4500 m; and 45g/l at altitudes higher than 4500 m (Wu *et al.*, 2020).

2.7.5 Anemia prevalence, prevention and intervention standards in Rwanda

Despite the effort put in place to prevent anemia among pregnant women in Rwanda, anemia among pregnant women remains a public health concern, affecting 23% of pregnant women. Findings from Rwanda Demographic Health Surveys over the last 10 years showed that the prevalence of anemia has declined substantially since 2005 when 26% of women were anemic. Findings from Rwanda Demographic Health Surveys over the last 10 years showed that the prevalence of anemia has declined substantially since 2005 when 26% of women were anemic (Habyarimana *et al.*, 2020). However, the prevalence of anemia has stagnated in recent years, which in the other manner suggests the additional efforts to fight and effectively prevent anemia among pregnant mothers. Iron deficient anemia is prominent among pregnant women, The Rwandan diet is based on cereals, legumes, and tubers that are poor sources of readily absorbed iron, and there appears to be very little iron supplementation (Profile, 2015). Malaria pays less contribution of anemia among pregnant women due to highly distributed mosquito nets among pregnant women at the first trimester of pregnancy in every hospital setting of the country, as a result, only 0.7% suffer from anemia secondary to malaria among pregnant women (Donahue Angel, *et al.*, 2017). And the prevalence of intestinal parasites or urinary parasites associated with chronic blood loss among pregnant women in Rwanda is at a low level. Thus, inadequate dietary iron intake and associated knowledge among pregnant women is a crucial part of anemia presence among pregnant women in Rwanda (Habyarimana, *et al.*, 2020).

According to the World Health Organization, iron deficiency is considered a public health concern if the prevalence of anemia exceeds 5% of the population, pregnant women are generally known to be more vulnerable to iron deficiency causing anemia. It is the type of anemia that affects Rwandan pregnant women which is however mostly related to a low level of

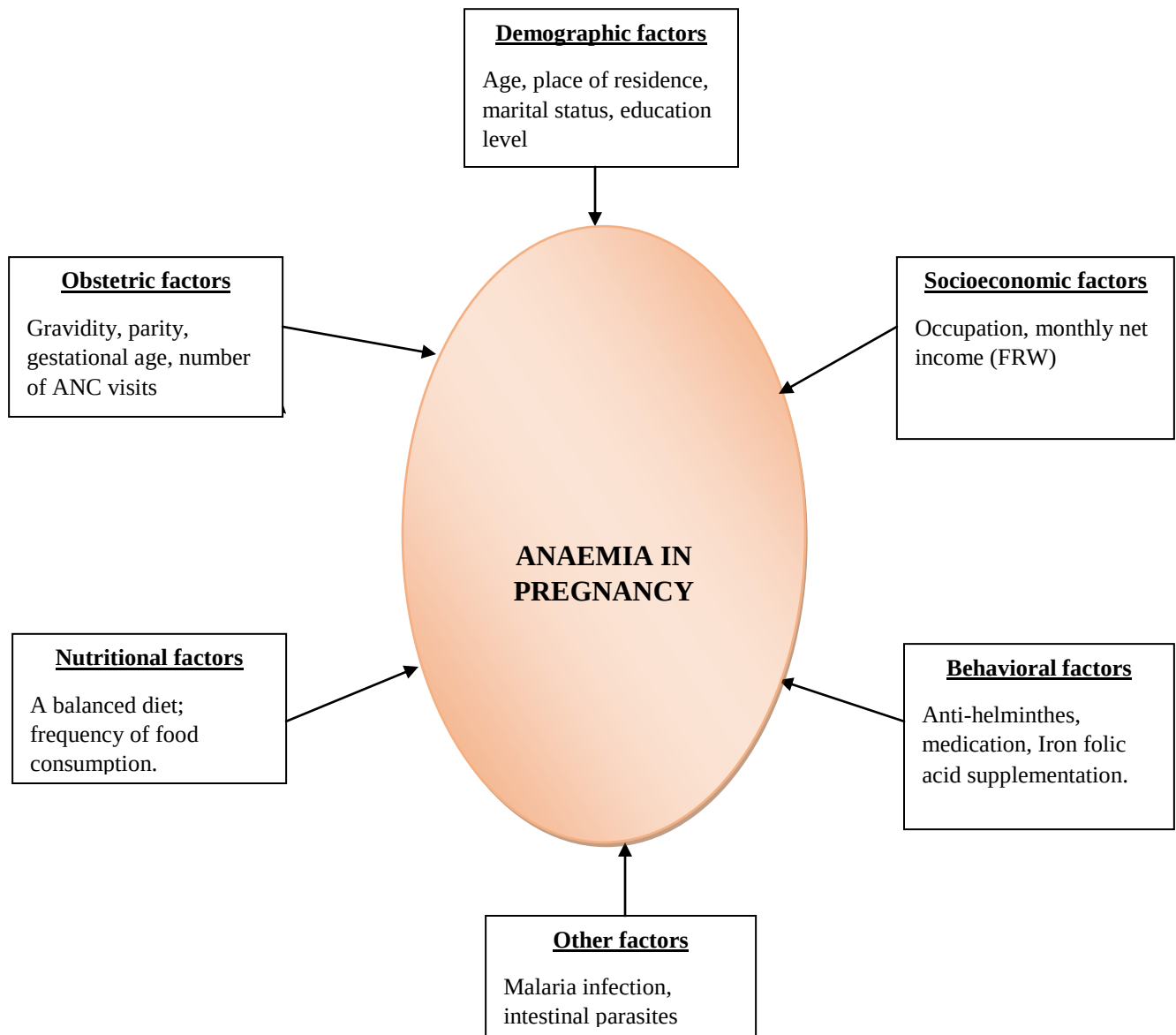
education, poverty, and a lack of access to food rich in iron. Studies have found that certain diet components are a risk factor of anemia, such as folic acid, vitamin A, B12, C, as well as inadequate protein intake (Donahue Angel *et al.*, 2017).

The government of Rwanda developed various initiatives to eradicate anemia among pregnant women, one example of such an initiative is the promotion and introduction of biofortified crops among farmers since 2012, especially iron-biofortified beans (Hakizimana *et al.*, 2019). This strategy reflected low cost and had a positive impact on hemoglobin concentration in blood. Recently, a study conducted on women at the University of Rwanda Huye campus, their findings showed an increase of iron status among women who consumed iron-biofortified beans. There are campaigns launched against anemia twice –yearly, mother and child week events were held for vitamin A supplementation and deworming, food security strategies, and improvement of maternal health through every trimester visits, control, and prevention of complications to pregnancy (Habyarimana *et al.*, 2020).

2.8 Conceptual framework

The present conceptual frameworks depict in an illustrative manner the variables put together (independent variables) for influencing the prevalence of anemia in pregnancy (dependent variable) among the pregnant women attending the HFs of Kibogora Hospital. Many of those variables or factors were identified by previous studies as the distal factors to justify the existence of anemia among pregnant women over the world, **fig 1**.

Figure 1. Conceptual framework



Source: Previous literature on anemia among pregnant mothers.

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

3.0 Introduction

This chapter deals with research methodology, it describes the research approach and design, target population, data collection procedures, and instruments used during this research. It provides information about materials, study area descriptions, and methods used to carry out this study.

3.1 Research approach and design

The study used a quantitative cross-sectional design. The cross-sectional study involves looking at people who differ on one key characteristic at one specific point in time (Levin A., 2014).

3.2 Study setting

The study was carried out in two health facilities of Kibogora Hospital; namely Kibogora District Hospital and Kibogora Health Center. It was targeting the pregnant women attending those HFs seeking care. Both HFs under our study setting are located in the Western province of Rwanda, Nyamasheke District, Kanjongo sector, and Kibogora cell. Kibogora HC is equipped with 11 beds, 13 nurses, and one midwife. On the monthly average Kibogora HC receives between 100 and 120 pregnant women. At Kibogora DH, the gyneco-obstetric department is equipped with 26 beds, 23 staff in total (nurses and midwives combined), it receives at least a monthly average of 280 pregnant women.

3.3 Target population

The target population was pregnant women attending antenatal care services within Kibogora DH and Kibogora HC with the monthly average estimates between 100 and 120 for Kibogora HC and 280 for Kibogora DH.

3.4 Sampling procedures

The study used probability sampling, especially a simple random sampling with an equal participation chance of all pregnant women in the study.

3.5 Sample size

The sample size was obtained from pregnant mothers attending Kibogora DH and Kibogora HC. As the prevalence of anemia among pregnant women in the Kibogora catchment area is unknown, the researcher has used 13.1% (Rwanda national anemia prevalence among women) for calculating the sample size. This was used as recommended by Fisher where there is a proportion of the target population assumed to have the characteristics of interest. Therefore, the sample size was determined using Fisher's statistical formula (Fisher et al., 1998) as the following; $n =$

$$\frac{z^2 \times P(1-P)}{d^2}$$

Where n = the sample size required, z = Confidence level at 95% (standard value of 1.96);

P = prevalence of anemia among pregnant women estimated at 13.1% or 0.13, d = Level of precision at ≤ 0.05 .

Thus;

$$n = \frac{1.96^2 \times 0.13(1 - 0.13)}{0.05^2}$$

$$n = 174$$

3.6 Research instruments for data collection

The study used the questionnaire as the tool for collecting primary data. The questionnaire is originated in English and was translated into Kinyarwanda to facilitate the participants who are not

good at English. This method of data collection was preferred for this study due to its ease in collecting data, friendly cost of administration in terms of time and money.

3.7 Data collection procedures

To conduct this study and to gather reliable information, the researcher used the quantitative approach in this study by collecting primary data. The primary data were directly collected from pregnant mothers received at Kibogora DH and Kibogora HC. The questionnaire was distributed to pregnant mothers, and data collection started after being provided ethical clearance from KP and permission from the management of Kibogora Hospital.

3.8 Ethical considerations

The ethical approval from Kibogora polytechnic and authorization from Kibogora Hospital's office administration delivered the acceptance to the research within the setting. Then, we requested a short time meeting with pregnant mothers in order to explain more about the study, and request their free participation. Those who agreed to participate in the study were given a questionnaire and their questions toward the research were highly received and given passable explanations. This was done through a process of informed consent in which participants were precisely informed of the purpose, method, risks, benefits, and alternatives to the study, understand this information and how it relays to their clinical situation or interests, and make a voluntary decision about their participation. Respecting their privacy and keeping their information confidential, respecting their right to change their mind, to decide that the research does not match their interests, and to withdraw without penalty.

3.9 Data analysis

Data analysis is the process of organizing individual pieces of data into meaningful information, statistical procedures aid researchers in summarizing, organizing, evaluating, interpreting, and communicating numerical information. According to Brink and Wood (2011), the method of data analysis differs according to the type of study, the sampling procedures, and the complexity of data collection methods. On the questionnaire, answers to the questions were coded for facilitating their analysis using Statistical Package for Social Sciences (SPSS). In descriptive statistics, results were displayed in tables, frequencies, percentages, and charts, while in logistic regression analysis, the odds ratio and p-value were computed.

3.10 Reliability and validity

Questionnaire reliability was calculated after having pre-tested it among 10 pregnant women chosen purposively in ANC service of Mugonero Health Center (Mugonero HC is one of the health centers in a rural area with some geographical similarities with Kibogora HC but different from the study setting). The validity of instruments was measured by using the Content Validity Index (CVI) where the researcher computed the validity coefficient. The content validity index is equal to the total number of valid items divided by the total number of items. Thus, the content validity index (CVI) = $R/R+IR$; whereby R= relevant questions; IR= irrelevant questions. The instrument was certified valid when its minimum content validity index is at least 0.75

Total number of questionnaires = 10

Total number of valid questionnaires (R) = 8

Total number of Irrelevant questionnaires (IR) = 2

Content validity index = $8 / (8+2) = 0.80$. The content validity index is 0.80; thus the instruments are certified valid because the content validity index is more than the required minimum which is 0.75

The following is the interpretation for the reliability test; **Table 1**.

Table 1: Legend Cronbach's Test of Reliability

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.8 \leq \alpha < 0.9$	Good
$0.7 \leq \alpha < 0.8$	Acceptable (Surveys)
$0.6 \leq \alpha < 0.7$	Questionable
$0.5 \leq \alpha < 0.6$	Poor
$\alpha < 0.5$	Unacceptable

Source: *Legend Cronbach's Test of Reliability*

3.10.1 Results of the Cronbach's Alpha reliability test at Mugonero HC.

Table 2: Reliability Statistics

Cronbach's Alpha	N of Items
.80	10

Source: *Pre-test of reliability 2021*

The pre-test results from Mugonero HC was analyzed where it has shown the statistical reliability of 0.80(e.g.,80%) which categorized between $0.8 \leq \alpha < 0.9$. Therefore, this is considered as Good according to legend Cronbach's Test of Reliability.

CHAPTER FOUR: DATA PRESENTATION, ANALYSIS, INTERPRETATION, AND SUMMARY.

4.0 Introduction

The fourth chapter of this study presents the findings after having analyzed the information collected from the 174 respondents. Descriptive statistics about demographic information, socio-economic, obstetrical, nutritional, behavioural, and other aspects of the respondents were produced. Thereafter, a logistic regression analysis was computed for testing the level of association between the independent and dependent variables

4.1 Data presentation and analysis

4.1.1 Socio-demographic characteristics of the respondents

Table 3: Socio-demographic characteristics of the respondents

Overall sample		(n=174)
Items	Frequency	Percentage
Age category		
15-20	9	5.20%
21-30	94	54.00%
31-40	62	35.60%
Above41	9	5.20%
Residence		
Rural	162	93.10%
Urban	12	6.90%
Marital Status		
Married	139	79.90%
Separated	15	8.60%
Single	20	11.50%

Education		
None	37	21.30%
Primary	96	55.20%
Secondary	41	23.60%

Source: Primary data collected from pregnant women attending Kibogora DH & Kibogora HC

Looking at the socio-demographic characteristics of 174 enrolled respondents, the table 3 of our study shows that about half (54.00%) were aged between 21-30 years, the majority (93.10%) reside in the rural settings, more than three quarters (79,9%) were married, one fifth has not attained any level of education while 55.2% and 23.6% have completed the primary and secondary education respectively.

4.1.2 Socio-economic characteristics of the respondents

Table 4: The socio-economic characteristics of the respondents

Overall sample		(n=174)
Items	Frequency	Percentage
Occupation of the pregnant mother		
Employed with casual Salary	77	44.30%
Employed with monthly Salary	8	4.60%
Self Employment	44	25.30%
Unemployed	45	25.90%
Occupation of Head of the Family		
Employed with casual Salary	81	46.60%
Employed with monthly Salary	20	11.50%
Self Employment	50	28.70%
Unemployed	23	13.20%

Monthly income of the pregnant mother		
Above FRW 30,000	37	21.30%
Below FRW 30,000	137	78.70%
Monthly income of the Head of the Family		
Above FRW 30,000	57	32.80%
Below FRW 30,000	117	67.20%

Source: Primary data collected from pregnant women attending Kibogora DH & Kibogora HC

About the socio-economic aspect of the respondents, table 4 mentions that occupation of the pregnant mothers, occupation of heads of the families, the monthly income of both pregnant mothers and heads of the families were considered. The majority (44.5%), and 46.6% of both the pregnant woman and heads of the families were employed with casual salary respectively while the combined unemployment (pregnant mothers and heads of the families) was estimated to be 39.08%. About the monthly incomes, the great proportion of the pregnant mothers (78.7%) was earning below RWF 30,000 compared with heads of families whose proportion was also estimated to be 67.2%. Therefore, only one-fifth (21.3%) of the pregnant mothers and about one-third (32.8%) of heads of the families had a monthly income above FRW 30,000 or USD 1 per day.

4.1.3 Obstetric aspects of the respondents

Table 5: Obstetrical aspects of the respondents

Overall sample		(n=174)
Item	Frequency	Percentage
Gravidity		
Multiple	130	74.70%
One	44	25.30%
Parity		
More than Four	21	12.10%
Four	5	2.90%
Three	32	18.40%
Two	51	29.30%
One	33	19.00%
Null Parity		18.40%
Gestational age		
Four Trimester	7	4.00%
Three Trimester	67	38.50%
Two Trimester	96	55.20%
One Trimester	4	2.30%
ANC Visits		
Four	34	19.50%
Three	44	25.30%
Two	88	50.60%
One	8	4.60%

Source: Primary data collected from pregnant women attending Kibogora DH & Kibogora HC

Looking at the obstetrical aspects of the respondents, table 5 shows that about three quarters (74.7%) of the mothers are multigravida and the parity two occupies about a third of the total

pregnant mothers in the study, the majority were in the gestational age of two trimesters, while a half (50.6%) had attended Kibogora DH & Kibogora HC for the 2nd visit of antenatal care,

4.1.4 Nutritional aspects of the respondents

Table 6: Nutritional aspects of the pregnant mothers who participated in this study

Overall sample		(n=174)
Items	Frequency	Percentage
Does the pregnant mother take a regular balanced diet?		
No	21	12.10%
Yes	153	87.90%
How often does the pregnant mother take a balanced diet per week?		
Between 1- 3 days per week	96	55.20%
Every day	32	18.40%
More than 4 days per week	30	17.20%
Neither	16	9.20%

Source: Primary data collected from pregnant women attending Kibogora DH & Kibogora HC

The table 6 of this study shows the important aspect regarding nutrition of the pregnant mothers where analysis demonstrates that the majority (87.9%) take a regular balanced diet,

4.1.5 Behavioral Aspects of the respondents

Table 7: Behavioral aspects of the pregnant women who participated in this study

Overall sample		(n=174)
Item	Frequency	Percentage
Do the pregnant women take anti helminthes medication during pregnancy period?		
No	104	59.80%
Partially	32	18.40%
Yes	38	21.80%

Do pregnant women take a full course of folic acid supplements during the pregnancy period?		
No	3	1.70%
Partially	32	18.40%
Yes	139	79.90%

Source: Primary data collected from pregnant women attending Kibogora DH & Kibogora HC

Regarding the behavioral aspects or the ability of the pregnant mothers to prevent and treat diseases that, several times, lead to anemia, the table 7 shows that only one fifth (21.8%) had taken the anti-helminths for intestinal parasites including worms while interestingly, more than three quarters (79,9%) undertook a full course of iron/ folic acid supplements during pregnancy.

4.1.6 Other aspects of the respondents

Table 8 : Intestinal parasites and malaria among the pregnant women who participated in the study

Overall sample			(n=174)
Items	Frequency	Percentage	
Do pregnant women suffer from intestinal parasites during pregnancy (confirmed by a laboratory test)?			
No	139	79.90%	
Yes	35	20.10%	
Do pregnant women suffer from malaria during pregnancy period (confirmed by a laboratory test)?			
No	143	82.20%	
Yes	31	17.80%	

Source: Primary data collected from pregnant women attending Kibogora DH & Kibogora HC

Apart from the above aspects, suffering from intestinal parasites and malaria, are likely, in many cases, to be the source of anemia among pregnant women. During this study, table 8 gives details on assessment of those two aspects and has shown that only about one fifth (20.1%) and 17.8% of

the pregnant women were confirmed being affected by the intestinal parasites and malaria, respectively.

4.1.7 Prevalence of anemia among the pregnant women

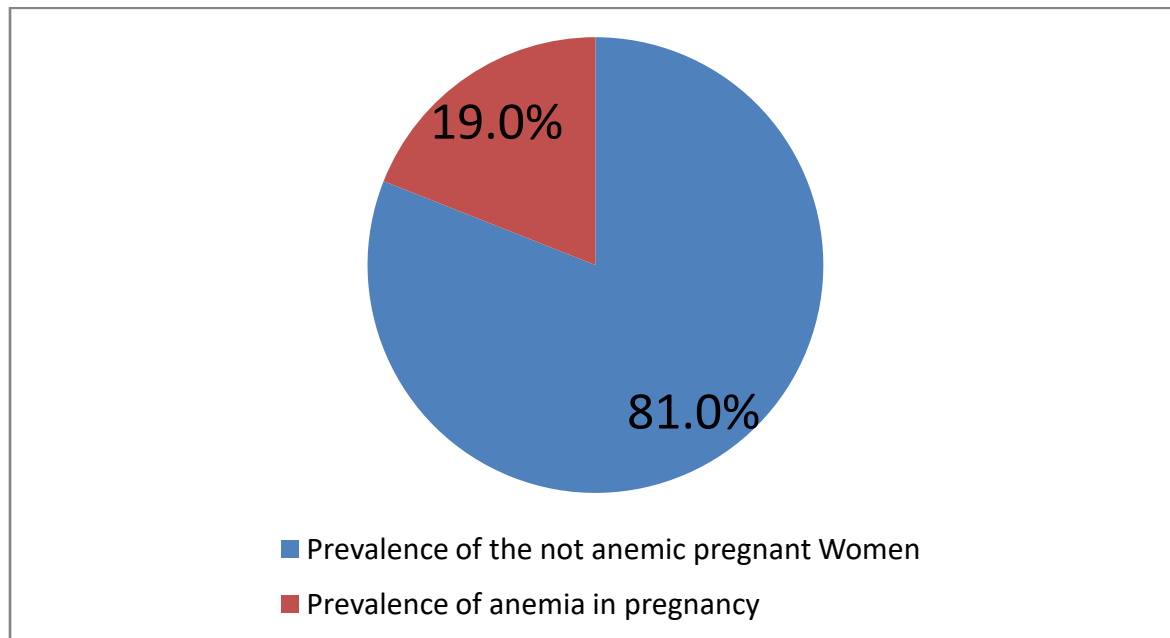
Table 9: Prevalence of anemia in pregnancy in Kibogora DH and Kibogora HC

Overall sample		(n=174)
	Frequency	Percentage
Anaemia among pregnant women		
No	141	81.00%
Yes	33	19.00%

Source: Primary data collected from pregnant women attending Kibogora DH & Kibogora HC

Table 9 of this study shows that among 174 pregnant mothers that participated in the study, the analysis showed that about one-fifth (19.0%) of them were confirmed having anemia while 141 (81.0%) were safe.

Figure 2 Anemia in pregnancy at Kibogora Hospital & Kibogora Health Center



Source: Primary data collected from the patients attending Kibogora DH and Kibogora HC

4.1.4 Logistic regression analysis

In order to determine factors associated with anemia among pregnant women attending Kibogora DH and Kibogora HC, excluding other possible confounding variables, the binary logistic model was used in order to test the level of association between the independent and dependent variables.

Table 10: Factors associated with anemia among pregnant women attending Kibogora DH and Kibogora HC.

Respondents characteristics	Answer	Anemia in Pregnancy				Logistic regression			
		No		Yes		Ref	cOR	P-value	[95% C.I]
		Frequency	%	Frequency	%				
Age category	15-20	9	6.4%	0	.0%	1		0.062	
	21-30	78	55.3%	16	48.5%				
	31-40	45	31.9%	17	51.5%				
	Above41	9	6.4%	0	.0%				
Marital Status	married	117	83.0%	22	66.7%	1		0.15	
	Separated	8	5.7%	7	21.2%				
	Single	16	11.3%	4	12.1%				
Education	Secondary	37	26.2%	4	12.1%	1	1.2	0.040**	[0.12, 1.33]
	Primary	78	55.3%	18	54.5%				
	None	26	18.4%	11	33.3%		1.3	0.000**	[1.00, 1.44]
Monthly Income (pregnant women) Monthly income (Head of family)	Below30000	108	76.6%	29	87.9%	1	2.6	0.012**	[1.00,4,43]
	Above30000	33	23.4%	4	12.1%				
	Above30000	41	29.08%	16	48.5%				
	Below30000	100	70.92	17	51.5%				

Gravidity	Multiple	109	77.3%	21	63.6%	1			
	One	32	22.7%	12	36.4%			0.104	
Parity	Four	5	3.5%	0	.0%	1			
	More than four	21	14.9%	0	.0%			0.278	
	Null Parity	20	14.2%	12	36.4%				
	One	25	17.7%	8	24.2%				
	three	22	15.6%	10	30.3%				
	Two	48	34.0%	3	9.1%				
Pregnant women with ANC Visits	Four	23	16.3%	11	33.3%	1		0.161	
	One	8	5.7%	0	.0%				
	Three	26	18.4%	18	54.5%				
	Two	84	59.6%	4	12.1%				
Regular Balanced Diet	No	14	9.9%	7	21.2%	1			
	Yes	127	90.1%	26	78.8%			0.378	
Full Folic Acid Intake	No	0	.0%	3	9.1%	1			
	Partially	17	12.1%	15	45.5%		2.1	0.030**	[2.7, 3.21]
	Yes	124	87.9%	15	45.5%	1			
Anti hermitic medication intake	No	78	55.3%	26	78.8%				
	Partially	25	17.7%	7	21.2%			0.642	
	yes	38	27.0%	0	.0%				
Malaria in Pregnancy	No	117	83.0%	26	78.8%	1			
	Yes	24	17.0%	7	21.2%			0.571	

**** indicates the statistically significant values. In the above table we kept only the odds and C.I with the statistically significant values.**

Source: Primary data collected from the patients attending Kibogora DH and Kibogora HC

Results of analysis contain in table 10 have shown that among the socio-demographic factors, not having attained any level of education increases by 1.3 times the chance of fall anemic among the pregnant mothers compared with those who completed the secondary education (cOR 1.3, 95% CI, 1.00, 1.44; P=0.000); having only completed the primary level increases also the chance of

becoming anemic by 1.2 times compared with the mothers who completed the secondary education (cOR 1.2, 95% CI, 0.12, 1.33; P=0.040). Looking at socioeconomic factors, earning the monthly income to the heads of families above FRW 30,000 increases about three times the chance of having anemia compared with mothers with the monthly income below FRW 30,000 (cOR 2.6, 95% CI, 1.00, 4.43; P=0.012) and lastly among the behavioral factors, partially intake of Iron and Folic acid to pregnant women increases by two times the chance of having anemia compared with their counterpart with a full course of Iron and Folic acid intake (cOR 2.1, 95% CI, 2.7, 3.21; P=0.030).

4.2 Discussions of findings

The present study sought to assess prevalence and factors associated with anemia among pregnant women attending ANC services in Kibogora DH and Kibogora HC. This section presents how our study findings link with previous knowledge reviewed in the literature, lessons learned, and implications from the existing policies. This study has revealed that anemia prevalence among pregnant women attending ANC services in Kibogora is estimated at 19%, and the identified statistical significant associated factors include; not having attained any level of education, having only completed the primary school level of education, earning the monthly income above FRW 30,000 by the heads of families (Women without or with the monthly income below FRW 30,000), and lastly, a partial intake of Folic acid to pregnant women.

4.2.1 Prevalence of anemia in pregnancy in Kibogora DH and Kibogora HC

Our study revealed that the prevalence of anemia among pregnant women attending ANC services in Kibogora DH and Kibogora HC is estimated at 19%. This is remaining higher than the national average, which the RDHS has estimated to be 13.1% and 12.7% in the Western province of Rwanda (National Institute of Statistics of Rwanda, Ministry of Health, The DHS Program ICF,

2020). However, the identified anemia on pregnancy in Kibogora is not far from the revealed by the study on risk factors of anemia among women of reproductive age in Rwanda which has estimated it to be 19.2% countrywide, and 17.9% in the Western Province of Rwanda (Hakizimana et al., 2019). Nevertheless, the prevalence of anemia in pregnancy in Kibogora is different from what was reported by the study on prevalence of anemia and its associated factors among married women in 19 sub-Saharan African countries using the Demographic and Health Surveys which estimated the anemia on pregnancy at 49.7% (Zegeye et al., 2021), and those conducted respectively in Pakistan (90.5%), India (87.2%), Malaysia (57.4%), Benin (68.3%), Nigeria (54.5%), Somali Region (56.8%), Walayita Sodo (40%), West Arsi zone (36.6%), and north western zone of Tigray (36.1%) (Gebre and Mulugeta, 2015, Siddalingappa, R. and C., 2016, Obse, Mossie and Gobena, 2013). The identified anemia prevalence in pregnant women of Kibogora may also be explained by the rural location of the study setting where the RDHS 2020 has shown that there is significant disparities between the prevalence of anemia among the pregnant women in the rural area (13.3%) compared with their counterpart in the urban area (12.3%) (National Institute of Statistics of Rwanda, Ministry of Health, The DHS Program ICF, 2020). The study conducted in Kampala, Uganda on the prevalence of anemia and its associated socio-demographic factors among pregnant women attending an antenatal care Clinic at Kisugu Health Center has also shown that anemia in pregnancy is mostly associated with the young age group of women less than 41 years old (Aziz Ali, et al., 2021). The study conducted in Kampala, Uganda on prevalence of anemia and its associated socio-demographic factors among pregnant women attending an antenatal care Clinic at Kisugu Health Center has also shown that anemia in pregnancy is mostly associated with the young age group of the women less than 41 years old (Mahamoud et al., 2020); this may also

explain the identified high prevalence in Kibogora DH and Kibogora HC where 94.8% of pregnant women were aged between 15- 30 years old.

4.2.2 Education level of the women

Our study revealed that education factors such as having completed the primary level of education or not having attained any level of education are likely to increase the anemia in pregnancy (cOR 1.2, 95% CI, 0.12, 1.33; P=0.040), and (cOR 1.3, 95% CI, 1.00, 1.44; P=0.000) respectively; these findings were proved to be in the same line with the previous studies conducted by Alemneh Mekuriaw Liyew on prevalence and determinants of anemia among pregnant women in East Africa; A multi-level analysis of recent Demographic and Health Surveys reported that illiteracy level by women is statistically tested to have a significant association with anemia in pregnancy (Liyew et al., 2021a). In the same context, the prevalence of anemia was reported to be high among women from countries with high illiteracy as compared to those from the country with low illiteracy levels. The present finding was similar to the findings from other previous studies (Razi et al., 2016, Liyew et al., 2021a). This might be due to the fact that the illiterate women are, in most of the times economically unstable (Haque & Zulfiqar, 2016), and likely facing problems to achieve the nutritional requirements (foods rich in vitamin A, iron, and folic acid, etc.) during pregnancy which may result in anemia. There are also some evidence showing that illiterate women do not respect the planned ANC visits (Sarode, 2010)), and many of them are who have hard to be supplemented with iron during their pregnancy while they are in the highly iron demanding period, and therefore are most likely to develop iron deficiency anemia (Agarwal et al., 2008)

4.2.3 Monthly income of the women

Our study revealed that earning the monthly income above FRW 30,000 by the head of family is likely to increase three times the chance of having anemia in pregnancy compared to women with the monthly income below FRW 30,000 (cOR 2.6, 95% CI, 1.00, 4.43; P=0.012). Our study finding is in seemingly to be in the same line with the study showing that the increased wealth quintiles from lowest to second lowest reduce the risk of developing anemia by 57% (Gebre & Mulugeta, 2015). This finding is consistent with those revealed by other studies in low and middle-income countries, which found that the risk of anemia among women living in the lowest wealth quintile was increased when compared with those living in the fourth and fifth wealth quintiles. A study conducted in India showed that pregnant women with low socioeconomic classes were at increased risk of developing anemia compared with those in higher socioeconomic classes (Salhan et al., 2012, Viveki et al., 2012). These could be linked to the fact that women from lower socioeconomic status (SES) lack the money to purchase the quality or quantity of foods compared with those from higher SES. However, due to wealth index calculated from different household assets, studies on anemia in pregnancy conducted in Ethiopia, Pakistan, Nepal, Vietnam, and Malaysia argued also the association between anemia in pregnancy and the socioeconomic status but did not consider the effect of wealth index (Lostutter T.W., Lewis M.A., Concrance JM., Neighbors C., 2014, Lostutter T.W., Lewis M.A., Concrance JM., Neighbors C., 2014, Haidar, 2010).

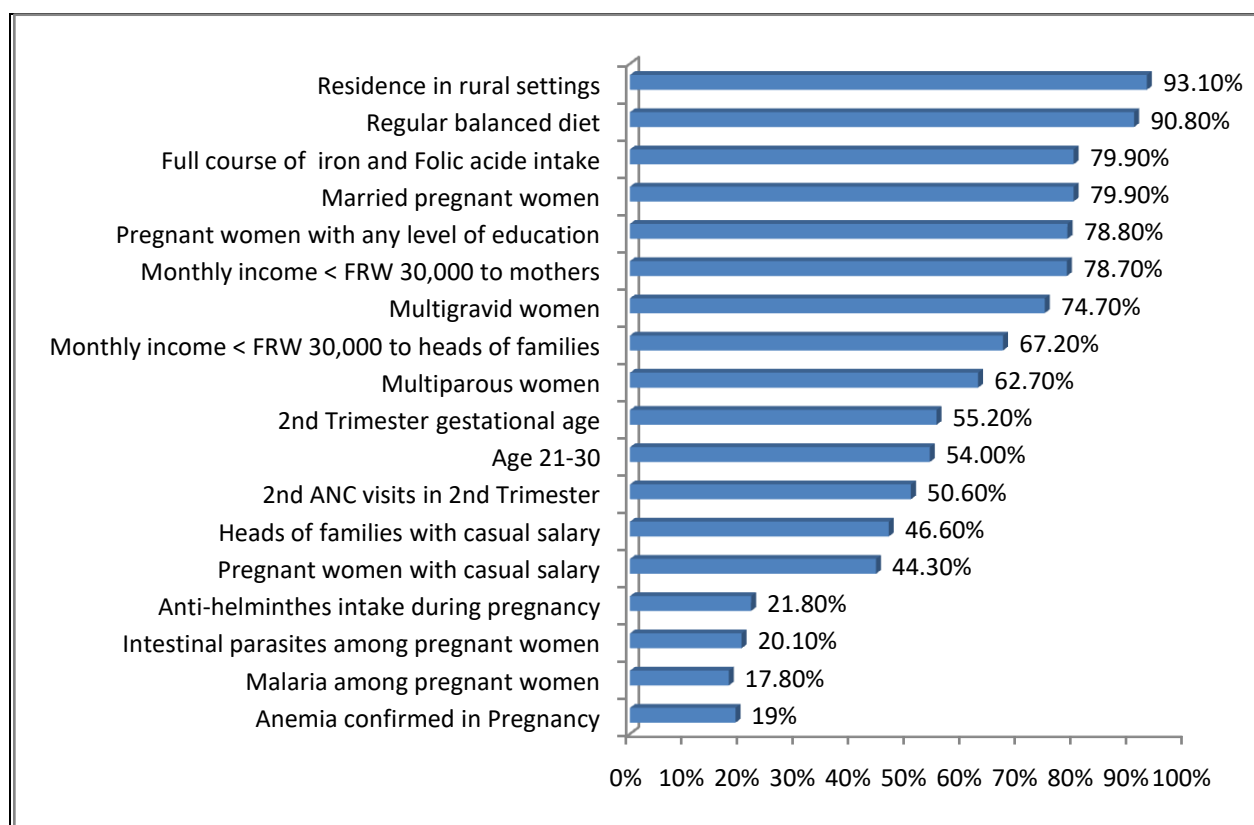
4.2.4 Partial intake of Folic acid by the pregnant women

Our study revealed that partial intake of Folic acid by pregnant women increases by two times the chance of having anemia compared with their counterpart with a full course of Iron and Folic acid intake (cOR 2.1, 95% CI, 2.7, 3.21; P=0.030). This finding is in the same line with

studies conducted in Vietnam and India, which reported that lack of iron supplementation is among the most significant risk factors for developing anemia during pregnancy (Aikawa et al., 2006, Viveki et al., 2012). Anemia in pregnancy has plateaued in recent years and originated from inadequate dietary iron intake and other maternal recurring diseases during pregnancy (Hakizimana *et al.*, 2019). Anemia in pregnancy might be due to iron deficiency developing during pregnancy resulting from the increased iron requirements to supply the expanding blood volume of the mother and the rapidly growing fetus and placenta. Our study finding is in contrast with the study conducted in Karnataka India, Uganda, and Eastern Ethiopia (Addis Alene & Mohamed Dohe, 2014, Nankinga & Aguta, 2019).

4.3 Summary of findings

Figure 3: Summary of the key characteristics of the pregnant women- respondents



Source: Primary data collected from the patients attending Kibogora DH and Kibogora HC

The above bar chart summarized the key findings of our study. Prevalence of anemia among the pregnant women attending Kibogora DH and Kibogora HC is estimated at 19%, and the identified associated factors are namely; not having attained any level of education, completing only the primary level of education, earning the monthly income to the heads of families above FRW 30,000, and partially intake of Folic acid to the pregnant mothers. Other key findings that describe the characteristics of the pregnant women attending Kibogora DH and Kibogora HC

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

The present study sought to determine the prevalence and identify factors associated with anemia among pregnant women attending health facilities of Kibogora hospital. It has recruited 174 participants among the pregnant women attending the HFs of Kibogora Hospital, specifically those who come for the antenatal consultations. This chapter summarizes the key findings, the conclusions drawn, recommendations, and suggestions for further studies.

5.1 Conclusion

Despite the care offered to women during pregnancy through the ANC service and the respect of WHO policies whether women consult the HF for pregnancy follow up, that include supplementation of folic acid starting from the first ANC visit, anemia in pregnancy is still present. This study allowed determining the prevalence of anemia among the pregnant women attending Kibogora DH and Kibogora HC and its associated factors.

Our study findings revealed that the prevalence of anemia in pregnancy is still high, but the identified factors behind are preventable. It is in this optic that the researcher formulates the following recommendations.

5.2 Recommendations

Based on the prevalence of anemia that is estimated at almost one-fifth (19%) of the pregnant women in Kibogora DH and Kibogora HC, and the associated factors, the recommendations targeting three domains of interventions are basically important in order to cope with the problem.

5.2.1 Education

1. Strengthen comprehensive education program targeting girls-future women especially in order to avoid school dropout since the pregnant women without school attendance, and or with only the primary level of education were evidenced to be more likely to become anemic during the pregnancy.

5.2.2 Socioeconomic factors

1. Develop and implement small income-generating activities targeting unemployed women to equip them with the capacity for maintaining a balanced diet.
2. Promote male involvement in the diet of pregnant women since anemia problem is prominent among pregnant women without or with the monthly income below FRW 30,000.

5.2.3 Behavioral aspects

1. Organize the sensitization sessions (IEC, BCC) regarding the intake of a balanced diet and the importance of Iron and Folic acid to pregnant women for combating anemia.

5.3 Suggestions for further study

As the present study did not explore any anemia aspects (moderate and severe) among pregnant women, further researchers should evaluate the anemia types in Kibogora DH and Kibogora HC in order to facilitate the ways of correcting them.

REFERENCES

- Addis Alene, K., & Mohamed Dohe, A. (2014). Prevalence of Anemia and Associated Factors among Pregnant Women in an Urban Area of Eastern Ethiopia. *Anemia*, 2014, 561567. <https://doi.org/10.1155/2014/561567>
- Agarwal, T., Kochar, G. K., & Goel, S. (2008). Impact of Iron Supplementation on Anemia During Pregnancy. *Studies on Ethno-Medicine*, 2(2), 149–151. <https://doi.org/10.1080/09735070.2008.11886327>
- Aikawa, R., Ngyen, C. K., Sasaki, S., & Binns, C. W. (2006). Risk factors for iron-deficiency anaemia among pregnant women living in rural Vietnam. *Public Health Nutrition*, 9(4), 443–448. <https://doi.org/10.1079/phn2005851>
- Alemu, T., & Umata, M. (2015). Reproductive and obstetric factors are key predictors of maternal anemia during pregnancy in Ethiopia: Evidence from demographic and health survey (2011). *Anemia*, 2015. <https://doi.org/10.1155/2015/649815>
- Annik, S., Id, H., Leikauf, G., Jakse, H., Siebenhofer, A., Haeusler, M., & Berghold, A. (2019). *Prevalence of anemia in pregnant women in Styria , Austria — A retrospective analysis of mother-child examinations 2006 – 2014*. 1–10.
- Ayensu, J., Annan, R., Lutterodt, H., Edusei, A., & Peng, L. S. (2020). Prevalence of anaemia and low intake of dietary nutrients in pregnant women living in rural and urban areas in the Ashanti region of Ghana. *PLoS ONE*, 15(1), 1–15. <https://doi.org/10.1371/journal.pone.0226026>
- Aziz Ali, S., Feroz, A., Abbasi, Z., Aziz Ali, S., Allana, A., Hambidge, K. M., Krebs, N. F., Westcott, J. E., McClure, E. M., Goldenberg, R. L., & Saleem, S. (2021). Perceptions of women, their husbands

- and healthcare providers about anemia in rural Pakistan: Findings from a qualitative exploratory study. *PloS One*, 16(4), e0249360. <https://doi.org/10.1371/journal.pone.0249360>
- Brien, K. O. O., & Ru, Y. (2017). *Iron status of North American pregnant women : an update on longitudinal data and gaps in knowledge from the United States and Canada*. 106(2).
- Chakrabarti, S., & Scott, S. P. (2019). *Impact of subsidized fortified wheat on anaemia in pregnant Indian women*. July 2018, 1–11. <https://doi.org/10.1111/mcn.12669>
- Col Madendag, I., Eraslan Sahin, M., Madendag, Y., Sahin, E., Demir, M. B., Acmaz, B., Acmaz, G., & Muderris, I. I. (2019). The Effect of Iron Deficiency Anemia Early in the Third Trimester on Small for Gestational Age and Birth Weight: A Retrospective Cohort Study on Iron Deficiency Anemia and Fetal Weight. *BioMed Research International*, 2019, 0–3. <https://doi.org/10.1155/2019/7613868>
- Derso, A., Nibret, E., & Munshea, A. (2016). Prevalence of intestinal parasitic infections and associated risk factors among pregnant women attending antenatal care center at Felege Hiwot Referral Hospital , northwest. *BMC Infectious Diseases*, 1–7. <https://doi.org/10.1186/s12879-016-1859-6>
- Donahue Angel, M., Berti, P., Siekmans, K., Tugirimana, P. L., & Boy, E. (2017). Prevalence of Iron Deficiency and Iron Deficiency Anemia in the Northern and Southern Provinces of Rwanda. *Food and Nutrition Bulletin*, 38(4), 554–563. <https://doi.org/10.1177/0379572117723134>
- Gebre, A., & Mulugeta, A. (2015). Prevalence of anemia and associated factors among pregnant women in north western zone of tigray, northern ethiopia: A cross-sectional study. *Journal of*

Nutrition and Metabolism, 2015(May 2013). <https://doi.org/10.1155/2015/165430>

Gebreweld, A., & Tsegaye, A. (2018). Prevalence and Factors Associated with Anemia among Pregnant Women Attending Antenatal Clinic at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia. *Advances in Hematology*, 2018. <https://doi.org/10.1155/2018/3942301>

Gibore, N. S., Ngowi, A. F., Munyogwa, M. J., & Ali, M. M. (2021). Dietary Habits Associated with Anemia in Pregnant Women Attending Antenatal Care Services. *Current Developments in Nutrition*, 5(1), 1–8. <https://doi.org/10.1093/cdn/nzaa178>

Gracitelli, C. P. B., Abe, R. Y., Tatham, A. J., Rosen, P. N., Zangwill, L. M., Boer, E. R., Weinreb, R. N., & Medeiros, F. A. (2015). Association Between Progressive Retinal Nerve Fiber Layer Loss and Longitudinal Change in Quality of Life in Glaucoma. *0946*(4), 384–390. <https://doi.org/10.1001/jamaophthalmol.2014.5319>

Habyarimana, F., Zewotir, T., & Ramroop, S. (2020). Prevalence and Risk Factors Associated with Anemia among Women of Childbearing Age in Rwanda Source of data. *24*(June), 141–151. <https://doi.org/10.29063/ajrh2020/v24i2.14>

Haidar, J. (2010). Prevalence of anaemia, deficiencies of iron and folic acid and their determinants in ethiopian women. *Journal of Health, Population and Nutrition*, 28(4), 359–368. <https://doi.org/10.3329/jhpn.v28i4.6042>

Hakizimana, D., Nisingizwe, M. P., Logan, J., & Wong, R. (2019). Identifying risk factors of anemia among women of reproductive age in Rwanda - A cross-sectional study using secondary data

- from the Rwanda demographic and health survey 2014/2015. *BMC Public Health*, 19(1), 1–11. <https://doi.org/10.1186/s12889-019-8019-z>
- Haque, A., & Zulfiqar, M. (2016). Women ' s Economic Empowerment through Financial Literacy , Financial Attitude and Financial Wellbeing. *International Journal of Business and Social Science*, 7(3), 78–88.
- Kanjilal, B. (2001). The World Nutrition Situation. *Journal of Health Management*, 3(1), 135–140. <https://doi.org/10.1177/097206340100300107>
- Kofie, P., Tarkang, E. E., Manu, E., Amu, H., Ayanore, M. A., Aku, F. Y., Komesuor, J., Adjuik, M., Binka, F., & Kweku, M. (2019). Prevalence and associated risk factors of anaemia among women attending antenatal and post-natal clinics at a public health facility in Ghana. *BMC Nutrition*, 5(1), 1–9. <https://doi.org/10.1186/s40795-019-0303-x>
- Kumera, G., Haile, K., Abebe, N., Marie, T., & Eshete, T. (2018). *Anemia and its association with coffee consumption and hookworm infection among pregnant women attending antenatal care at Debre Markos Referral Hospital , Northwest*. 1–14.
- Lebso, M., Anato, A., & Loha, E. (2017). Prevalence of anemia and associated factors among pregnant women in Southern Ethiopia: A community based cross-sectional study. *PLoS ONE*, 12(12), 1–11. <https://doi.org/10.1371/journal.pone.0188783>
- Lin, L., Wei, Y., Zhu, W., Wang, C., Su, R., Feng, H., & Yang, H. (2018). *Prevalence , risk factors and associated adverse pregnancy outcomes of anaemia in Chinese pregnant women : a multicentre retrospective study*. 1–8.

- Liyew, A. M., Tesema, G. A., Alamneh, T. S., Worku, M. G., Teshale, A. B., Alem, A. Z., Tessema, Z. T., & Yeshaw, Y. (2021a). Prevalence and determinants of anemia among pregnant women in East Africa; A multi-level analysis of recent demographic and health surveys. *PLoS ONE*, 16(4 April 2021), 1–15. <https://doi.org/10.1371/journal.pone.0250560>
- Liyew, A. M., Tesema, G. A., Alamneh, T. S., Worku, M. G., Teshale, A. B., Alem, A. Z., Tessema, Z. T., & Yeshaw, Y. (2021b). Prevalence and determinants of anemia among pregnant women in East Africa; A multi-level analysis of recent Demographic and Health Surveys. *PloS One*, 16(4), e0250560. <https://doi.org/10.1371/journal.pone.0250560>
- Lostutter T.W., Lewis M.A.,Concurrence JM., Neighbors C., L. M. . (2014). 基因的改变NIH Public Access. *Bone*, 23(1), 1–7.
- Mahamoud, N. K., Mwambi, B., Oyet, C., Segujja, F., Webbo, F., Okiria, J. C., & Taremwa, I. M. (2020). Prevalence of anemia and its associated socio-demographic factors among pregnant women attending an antenatal care clinic at kisugu health center IV, makindye division, Kampala, Uganda. *Journal of Blood Medicine*, 11, 13–18. <https://doi.org/10.2147/JBM.S231262>
- Mengist, H. M., Zewdie, O., & Belew, A. (2017). Intestinal helminthic infection and anemia among pregnant women attending ante - natal care (ANC) in East Wollega , Oromia ,. *BMC Research Notes*, 1–9. <https://doi.org/10.1186/s13104-017-2770-y>
- Nankinga, O., & Aguta, D. (2019). Determinants of Anemia among women in Uganda: Further analysis of the Uganda demographic and health surveys. *BMC Public Health*, 19(1), 1–9. <https://doi.org/10.1186/s12889-019-8114-1>

- National Institute of Statistics of Rwanda, Ministry of Health, The DHS Program ICF. (2020). Rwanda Demographic and Health Survey 2019-2020: key indicators report. In *Demographic and Health Surveys* (Vol. 53, Issue 9).
- Ndegwa, S. K. (2019). Anemia & Its Associated Factors Among Pregnant Women Attending Antenatal Clinic At Mbagathi County Hospital, Nairobi County, Kenya. *African Journal of Health Sciences*, 32(1), 59–73.
- NISR. (2015). Rwanda Demographic and Health Survey 2014-15 - Final Report. In *Rwanda*. <https://doi.org/March, 2016>
- Obse, N., Mossie, A., & Gobena, T. (2013). Magnitude of Anemia and Associated Risk Factors Among Pregnant Women Attending Antenatal Care. *Ethiop J Health Sci.*, Vol. 23(No. 2), 165–173.
- Oladeinde, B. H., Omoregie, R., Odia, I., & Oladeinde, O. B. (2012). Prevalence of malaria and anemia among pregnant women attending a traditional birth home in Benin city, Nigeria. *Oman Medical Journal*, 27(3), 232–236. <https://doi.org/10.5001/omj.2012.52>
- Profile, N. A. (2015). *National Anemia Profile*.
- Razi, S., Zaidi, H., Muzaffer, A., Fayyaz, S., & Naqvi, A. F. (2016). *FEMALE LITERACY AND ANEMIA IN PREGNANCY : EXPLORING*. 27(3), 72–74.
- Robalo Nunes, A., Mairos, J., Brilhante, D., Marques, F., Belo, A., Cortez, J., & Fonseca, C. (2020). Screening for Anemia and Iron Deficiency in the Adult Portuguese Population. *Anemia*, 2020. <https://doi.org/10.1155/2020/1048283>

- Salhan, S., Tripathi, V., Singh, R., & Gaikwad, H. S. (2012). Evaluation of hematological parameters in partial exchange and packed cell transfusion in treatment of severe anemia in pregnancy. *Anemia*, 2012. <https://doi.org/10.1155/2012/608658>
- Sarode, V. M. (2010). Does illiteracy influence pregnancy complications among women in the slums of greater Mumbai. *International Journal of Sociology and Anthropology*, 2(5), 82–94. <http://www.academicjournals.org/ijsa>
- Siddalingappa, H., R., N., & C., A. (2016). Prevalence and factors associated with anaemia among pregnant women in rural Mysore, Karnataka, India. *International Journal of Community Medicine and Public Health*, 3(9), 2532–2537. <https://doi.org/10.18203/2394-6040.ijcmph20163067>
- Sunguya, B. F., Ge, Y., Mlunde, L., Mpembeni, R., Leyna, G., & Huang, J. (2021). High burden of anemia among pregnant women in Tanzania: a call to address its determinants. *Nutrition Journal*, 20(1), 65. <https://doi.org/10.1186/s12937-021-00726-0>
- Susanti, A. I., Sahiratmadja, E., Winarno, G., Sugianli, A. K., Susanto, H., & Panigoro, R. (2017). *Low Hemoglobin among Pregnant Women in Midwives Practice of Primary Health Care , Jatinangor , Indonesia : Iron Deficiency Anemia or ? -Thalassemia Trait ? 2017.* <https://doi.org/10.1155/2017/6935648>
- Tan, J., He, G., Qi, Y., Yang, H., Xiong, Y., Liu, C., Wang, W., Zou, K., Lee, A. H., Sun, X., & Liu, X. (2020). *Prevalence of anemia and iron deficiency anemia in Chinese pregnant women (IRON WOMEN): a national cross-sectional survey.* 1–12.

- Teshale, A. B., Tesema, G. A., Worku, M. G., Yeshaw, Y., & Tessema, Z. T. (2020). Anemia and its associated factors among women of reproductive age in eastern Africa: A multilevel mixed-effects generalized linear model. *PLoS ONE*, *15*(9 September), 1–16.
- Tulu, B. D., Atomssa, E. M., & Mengist, H. M. (2019). Determinants of anemia among pregnant women attending antenatal care in Horo Guduru Wollega Zone, West Ethiopia: Unmatched case-control study. *PLoS ONE*, *14*(10), 1–13. <https://doi.org/10.1371/journal.pone.0224514>
- Viveki, R., Halappanavar, A., Viveki, P., Halki, S., Maled, V., & Deshpande, P. (2012). Prevalence of Anaemia and Its Epidemiological Determinants in Pregnant Women. *Al Ameen Journal of Medical Sciences*, *5*.
- White, N. J. (2018). Anaemia and malaria 11 Medical and Health Sciences 1108 Medical Microbiology 11 Medical and Health Sciences 1103 Clinical Sciences. *Malaria Journal*, *17*(1), 1–17. <https://doi.org/10.1186/s12936-018-2509-9>
- World Health Organization. (2016). WHO malaria terminology. *Who*, 31.
- Wu, Y., Ye, H., Liu, J., Ma, Q., Yuan, Y., Pang, Q., Liu, J., Kong, C., & Liu, M. (2020). *Prevalence of anemia and sociodemographic characteristics among pregnant and non-pregnant women in southwest China : a longitudinal observational study*. 1–10.
- Yadav, U. K., Ghimire, P., Amatya, A., & Lamichhane, A. (2021). Factors Associated with Anemia among Pregnant Women of Underprivileged Ethnic Groups Attending Antenatal Care at Provincial Level Hospital of Province 2, Nepal. *Anemia*, 2021. <https://doi.org/10.1155/2021/8847472>

Zegeye, B., Anyiam, F. E., Ahinkorah, B. O., Ameyaw, E. K., Budu, E., Seidu, A. A., & Yaya, S. (2021). Prevalence of anemia and its associated factors among married women in 19 sub-Saharan African countries. *Archives of Public Health*, 79(1), 1–12. <https://doi.org/10.1186/s13690-021-00733-x>

Appendices

APPENDIX ONE: PARTICIPANT INFORMED CONSENT FORM

Research topic: Prevalence and factors associated with anemia among pregnant women at Kibogora hospital's catchment area

Supervisor's name: KANAKUZE Chris Adrien, BSM,MSN,RM

A. PURPOSE

We, NYINAWUMUNTU Shoza and MUJAWIMANA Diane, are conducting academic research project aimed to assess prevalence and factors associated with anemia among pregnant women attending Kibogora hospital's catchment area. And we are doing this research study under the supervision of our lecturer KANAKUZE Chris Adrien.

B. PROCEDURES

If you agree to participate in this study, you will be given information regarding the study. You will be given questionnaire with questions that you have to answer within a minimum time of 20 minutes. Before answering questions you will be given time to ask question on what you do not understand.

RISKS

There are no risks associated with participating in this research; your responses will only be available to the researcher. Your participation is completely voluntary and you have a right to withdraw from participation at any level of filling the questionnaire.

C. CONFIDENTIALITY

Do not write any personal identification on the questionnaire. The responses you give to the questions will remain confidential and anonymous. All respondents' forms are coded and your responses will not be used to identify you. The information provided even if published will not be used to identify you in any way and hence anonymity is assured.

D. BENEFITS OF PARTICIPATION

There are no direct benefits to you. However, if you agree to participate in this study, your contribution will be useful on the prevalence and factors associated with anemia among pregnant women attending Kibogora Hospital's Catchment area.

E. VOLUNTARY PARTICIPATION

Participation is voluntary and refusal to participate will involve no penalty or loss of benefits to which the subjects are otherwise entitled.

F. QUESTIONS

You are encouraged to ask any questions to clarify any issues at any time or ask questions at any time during your participation in the study. If you later think you need more information you may call **0787223492/0789451308**

CONSENT

You are making a decision whether or not to participate in this research study. your signature below indicates that you have decided to participate in the study after reading all of the information above and you understand the information in this form, have any questions answered and have received a copy of this form for you to keep.

Signature.....Date.....

Addresses of the Principal Investigators and the research supervisor :

NYINAWUMUNTU Shoza and MUJAWIMANA DIANE
Tel _____ Signature _____ Tel _____ Signature _____

Principal Investigators

KANAKUZE Chris Adrien, BSM,MSN,RM _____
Tel: _____ Signature Date

Research supervisor

URUPAPURO RWUZUZWA N'UMUNTU WEMEYE KUGIRA URUHARE MU BUSHAKASHATSI

Twebwe, NYINAWUMUNTU Shoza na MUJAWIMANA DIANE. Turi gukora ubushakashatsi bugamije kugaragaza “ UMUBARE W'ABABYEYI BATWITE BAGIRA IKIBAZO CYO KUBURA AMARASO NDETSE N'IKIBITERA” . Nta bihembo biteganyijwe ku muntu ugize uruhare muri ubu bushakashatsi, ariko amakuru azava muri ubu bushakashatsi azafasha kumenya bimwe mu bintu bituma habaho ikibazo cyo kubura amaso ku babyeyi batwite bityo bigashyira mu kaga ubuzima bwabo n'ubw'abana batwite, bityo, hatekerezwe ingamba zafatwa ngo hakumirwe ibyo bibazo.

Kugira uruhare muri ubu bushakashatsi ni ubushake, nta mwirondoro usabwa kumuntu ugize uruhare muri ubu bushakashatsi kandi uzagiriwe ibanga ku makuru yose utanga. Ufite uburengazira bwo kubaza no gusobanukirwa ku bibazo byose ushaka cyangwa kuva mu bushakashatsi igihe cyose ubishaka nta ngaruka yindi iyo ariyo yose bikugizeho.

Nyuma yo gushyira umukono kuri iyi nyandiko yo kugira uruhare muri ubu bushakashatsi uhabwa kopi.

Icyemezo cy'ugira uruhare mu bushakashatsi

Njyewe.....ndemera kugira uruhare muri ubu bushakashatsi nyuma yo gusobanurirwa no gusobanukirwa byimbitse intego yabwo.

Umukono w'uwigize uruhare muri ubu bushakashatsi,, **Itariki**..../...../.....

Aderesi y'uhagarariye ubushakashatsi n'ureberera niba ubushakashatsi bukorwa uko bikwiriye:

NYINAWUMUNTU Shoza na MUJAWIMANA DIANE

Tel _____ **umukono** _____ **Tel** _____ **Umukono** _____

KANAKUZE Chris Adrien, BSM,MSN,RM _____

Tel: _____ **Umukono** _____ **Itariki** _____

Ureberera niba ubushakashatsi bukorwa uko bikwiriye

APPENDIX TWO: QUESTIONNAIRE

This questionnaire contains different questions grouped into five sections that correspond to study variables (independent and dependent) that intend to assess the prevalence of anemia and its associated factors.

Tick in the box provided and write where is required.

Date of the research..... Respondent number/2022

SECTION 1 Socio-demographic characteristics of the participants

Questions	Answer	Tick
Q1. Age category(years)	15-20	
	>20-30	
	> 30-40	
	Above 41	
Q2. Place of residence (during the pregnancy period)	Urban	
	Rural	
Q3. Marital status	Married	
	Single	
	Separated	
Q4. Select your education level	None	
	Primary	
	Secondary	
	Tertiary	

SECTION 2. Social economic factors

Questions	Answer	Tick
Q5.Occupation of the mother	Employed with the monthly salary	
	Employed with the daily/ casual salary	
	Self employment	
	Unemployed	
Q6. Occupation of the head of the family	Employed with the monthly salary	
	Employed with the daily/ casual salary	
	Self employment	
	Unemployed	
Q7.Mother's monthly income	<30,000	
	≥ 30,000***	
Q8. Head of the family's monthly income	<30,000	
	≥ 30,000	

*** This total amount could justify the individual's ability to earn at least 1USD dollar per day.

SECTION 3. Obstetric factors

Questions	Answer	Tick
Q9.Gravidity	One	
	multiple	
Q10. Parity	Null parity	
	Para 1	
	Para 2	
	Para 3	
	>Para 4	
Q11. Gestational age (in trimesters)	1 st trimester	
	2 nd trimester	
	3 rd trimester	
Q12. Number of ANC Visits	1	
	2	
	3	
	4	

SECTION 4: Nutritional factors

Questions	Answer	Tick
Q13. Does the pregnant mother take a regular balanced diet?	Yes	
	No	
Q14. How often does the pregnant mother take the balanced diet per week?	Every day	
	More than 4 days per week	
	Between 1- 3 days per week	
	Neither	

SECTION 5. Behavioral factors

Questions	Answer	Tick
Q15. Does the pregnant takes a full course of iron/ folic acid supplements during pregnancy period?	Yes	
	Partially	
	No	
Q16. Does the pregnant mother takes IPT during pregnancy period?	Yes	
	Partially	
	No	
Q17. Does the pregnant mother takes anti-helminthes medication during pregnancy period?	Yes	
	Partially	
	No	

SECTION 6. Other factors

Questions	Answer	Tick
Q18. Does the pregnant mother suffered from malaria during the pregnancy period (confirmed by a laboratory test)?	Yes	
	No	

Q19. Does the pregnant mother suffered from the intestinal parasites during pregnancy (confirmed by a laboratory test)?	Yes	
	No	

SECTION 7. Anemia prevalence among the pregnant mothers

Questions	Answer	Tick
Q20. Does the pregnant mother have anemia (confirmed by a healthcare provider?)	Yes	
	No	
Q21. Which of the following symptoms does the pregnant mother had / have during the pregnancy period? (Multiple choice is allowed)	Pale or yellowish skin	
	Dizziness	
	Cold hands and feet	
	Headache	

Thank you!!

URUTONDE RW'IBIBAZO BY'UBUSHAKASHATSI

Igika cya mbere: umwirondoro w'umugore utwite

Ibibazo	Ibisubizo	Hitamo
Q1. Ufite imyaka ingahe?	15-20	
	21-30	
	31-40	
	Above 41	
Q2. Utuye he muri iki gihe utwite?	Mu mug	
	Mu cyaro	
Q3. Irangamimerere ryawe ni irihe ?	Urubatse	
	Ingaragu	
	mwaratandukanye	
Q4. Ni ikihe cyiciro cy'amashuri warangije?	Ntacyo	
	Abanza	
	Ayisumbuye	
	Kaminuza	

Igika cya kabiri: Imibereho n'ubutunzi

Q5. Tubwire ku bijyanye n'akazi ukora.	Ukorera umuntu cg ikigo kiguhemba ku kwezi	
	Ukora nyakabyizi uhembwa buri munsi cg kenshi mu kwezi	
	Urikorera	
	Nta kazi ugira uhemberwa	
Q6. Tubwire ku bijyanye n'akazi umutware w'umuryango akora	Akorera umuntu cg ikigo kimuhemba ku kwezi	
	Akora nyakabyizi agahembwa buri munsi cg kenshi mu kwezi	
	Arikorera	
	Nta kazi agira ahemberwa	
Q7. Ugereranyije winjiza amafaranga angahe mu kwezi?	Ari hasi ya 30.000 FRW	

	Angana cg arenze 30,000Frw	
Q8. Ugereranyije umutware w'umuryango yinjiza amafaranga angahe mu kwezi?	Ari hasi ya 30.000 FRW	
	Angana cg arenze 30,000Frw	

Igika cya gatatu: ibijyanye no gutwita

Q9. Umaze gutwita inda zingahe?	imwe	
	nyinshi	
Q10. Ufite imbyaro zingahe?	Ntanimwe	
	1	
	2	
	3	
	> 4	
Q11. Inda utwite imaze amezi angahe(mu bihembwe)	Igihembwe cya mbere	
	Igihembwe cya kabili	
	Igihembwe cya gatatu	
Q12. Umaze gusuzumisha inda ku ivuriro inshuro zingahe?	Inshuro 1	
	Inshuro 2	
	Inshuro 3	
	Inshuro 4	

Igika cya kane: ibijyanye n'imirire y'umubyeyi utwite

Q13. Ese waba ufata indyo yuzuye?	yego	
	Oya	
Q14. Waba ufata indyo yuzuye kangahe mu cyumweru?	Buri muni	
	Inshuro zirenze iminsi 4 mu cyumweru	
	Hagati y'umunsi 1 kugeza ku minsi 3 mu cyumweru	
	Nta n'umunsi n'umwe mu cyumweru	

Igika cya 5. Ibijyanye n'imitwarire

Ibibazo	Ibisubizo	Hitamo
Q15. Ese waba ufata ibinini byongera amaraso ukabirangiza byose nk'uko ubihabwa na muganga	Yego	
	Rimwe na rimwe	
	Nta na rimwe	
Q16. Ese waba ufata imiti ikurinda kurwara malariya mu gihe utwite?	Yego	
	Rimwe na rimwe	
	Nta na rimwe	
Q17. Ese waba ufata imiti ikurinda kurwara inzoka zo munda mu gihe utwite?	Yego	
	Rimwe na rimwe	
	Nta na rimwe	

Igika cya gatandatu. Izindi mpamvu zatera kugira amaraso adahagije

Q18. Ese wigeze urwara kenshi malariya mu gihe utwite (byemejwe na muganga)?	Yego	
	Oya	
Q19. Ese waba urwara kenshi inzoka zo munda (ibiryi) mu gihe utwite (byemejwe na muganga)?	Yego	
	Oya	

Igika cya karindwi. Ibura ry'amaraso ku bagore batwite

Q20. Ese waba warabwiwe ko ufite amaraso adahagije mu gihe utwite (byemejwe na muganga)?	Yego	
	Oya	
Q21. Hitamo kimwe cyangwa byinshi ufite cyangwa ukunda kugira mu bimenyetso bikurikira:	Kwereruka cyangwa kuba umuhondo k'uruhu	
	Isereri	
	Ibiganza cyangwa ibirenge bihora bikonje	
	Kuribwa umutwe	

Murakoze!!

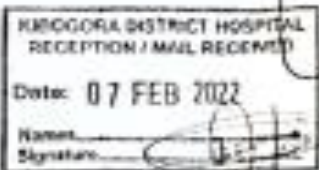
APPENDIX THREE: TIMEFRAME OF THE STUDY

Activities	Aug 2021	Sept 2021	Oct 2021	Nov 2021	Dec 2021	Jan 2022	Feb 2022	March 2022
Proposal writing								
Research ethical clearance								
Data collection								
Data entry								
Data clearing								
Data analysis								
Dissertation report writing								
Defense								

APPENDIX FOUR: BUDGET OF THE STUDY

Activities	Quantity	Unity	Unity cost (FRW)	Total Cost (FRW)
Proposal writing : Purchase of communication (Airtime)	1	pce	25,000	25,000
Research ethical clearance	1	pce	0	0
Data collection : Multiplication of the questionnaires	696	Pages	20	13,920
Data entry	174	records	0	0
Data clearing	174	records	0	0
Data analysis	1	FF	0	0
Dissertation report writing	1	FF	0	0
Printing of the final dissertation reports	324	pages	20	6,480
Defense panel decoration	1	FF	15,000	15,000
TOTAL				35,400

APPENDIX FIVE: STUDENT DISSERTATION PROJECT'S LETTER (KIBOGORA DH)

KIBOGORA DISTRICT HOSPITAL
RECEPTION / MAIL RECEIVED
Date: 07 FEB 2022
Name: _____
Signature: _____

visit H.R. and then, Dr. Head of Mater

Granted Accreditation and Legal Personality by the Ministerial Order N° 3/2015 Official Gazette N° 03 of 19/01/2015 P.O.Box: 31 Ruzizi-Rwanda Tel: (+250)280100759 E-mail: info@kp.ac.rw Website: www.kp.ac.rw

Student Dissertation Project's Letter

January, 28th 2022

To whom it may concern

We write this letter to humbly request you to allow Mrs NYINAWUMUNTU Shoza and MUZAWIMANA Diane (2001208&2000576) to conduct research in your organization/institution/territorial entity. The above mentioned are bonafide students of kibogora polytechnic pursuing bachelor's degree in general nursing department. These candidates are currently conducting a research entitled "PREVALENCE AND FACTORS ASSOCIATING WITH ANEMIA AMONG PREGNANT WOMEN ATTENDING KIBOGORA DISTRICT HOSPITAL(IN MATERNITY SERVICE)" we are convinced that your organization/institution/territorial entity will constitute a valuable source of information pertaining to their research. The purpose of this letter is to humbly request you to avail them with the pertinent information they may need. We pledge to ensure that all provided information will be used in the strict academic purpose.

Any assistance rendered to the candidates will be highly appreciated.

Approved by:

Yours,

Dr Eleazar NDABARORA, PhD
Dean of Health Sciences
Kibogora Polytechnic



APPENDIX SIX: STUDENT DISSERTATION PROJECT'S LETTER (KIBOGORA HC)



Granted Accreditation and Legal Personality by the Ministerial Order N° 7/2015 Official Gazette N° 03 of 19/01/2015 P.O.Box: 31 Ruzizi-Rwanda Tel:(+250)280100759 E-mail:info@kpac.rw Website: www.kpac.rw

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Approved by:

Yours,

Dr Elenzar NDABARORA, PhD

Dean of Health Sciences
Kibogora Polytechnic

